

WHAT IS CLAIMED IS:

1. A method of producing a micro structure on a substrate, comprising the steps of:

forming on a substrate a first positive
5 photosensitive material layer for photosensitizing by
ionizing irradiation of a first wavelength band in a
crosslinked state and forming a lower layer composed
of a crosslinked positive photosensitive material
layer by heat treating this positive photosensitive
10 material layer;

forming on the lower layer an upper layer
composed of a second positive photosensitive
material for photosensitizing by ionizing radiation
of a second wavelength band to thereby obtain a two-
15 layered structure;

forming the upper layer with a desired pattern
by irradiating the ionizing radiation of the second
wavelength band to a predetermined portion of the
upper layer of the two-layered structure and removing
20 only the irradiated area of the upper layer by
development treatment; and

forming the lower layer with a desired pattern
by irradiating the ionizing radiation of the first
wavelength band to a predetermined portion of the
25 lower layer exposed by the pattern forming of the
upper layer and conducting a development treatment,
wherein the first positive photosensitive

material layer includes a ternary copolymer having a
primary component composed of methyl methacrylate,
and methacrylic acid as a thermally crosslinkable
factor and another factor for extending a sensitivity
5 region relative to the ionizing radiation.

2. The method of claim 1, wherein the factor
for extending the sensitivity region relative to the
ionizing radiation is a methacrylate anhydride
10 monomer unit.

3. The method of claim 1, wherein the
crosslinkable process of the first positive
photosensitive material layer is carried out by
15 dehydration and condensation reaction.

4. The method of claim 2, wherein the ternary
copolymer contains methacrylate of 2 to 30% by weight
relative to the copolymer and is prepared by a cyclic
20 radical polymerization at a temperature of 100 to
120°C using an azo compound or peroxide as a
polymerization initiator.

5. The method of claim 1, wherein the weight
25 average molecular weight of the ternary copolymer is
ranging of 5,000 to 50,000.

6. The method of claim 1, wherein the first positive photosensitive material contains at least a photo-degradable resin having a structure of carboxylate anhydride.

5

7. The method of claim 1, wherein the first positive photosensitive material is an acrylic resin that is intermolecular crosslinked through the structure of carboxylate anhydride.

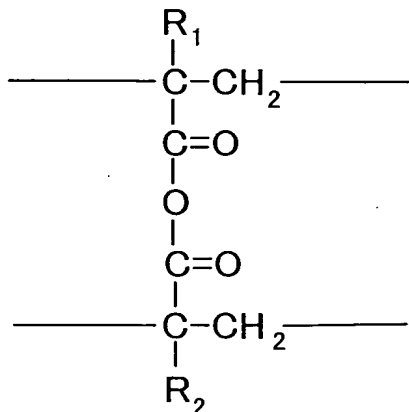
10

8. The method of claim 7, wherein the first positive photosensitive material is an acrylic resin having an unsaturated bond on a branched chain.

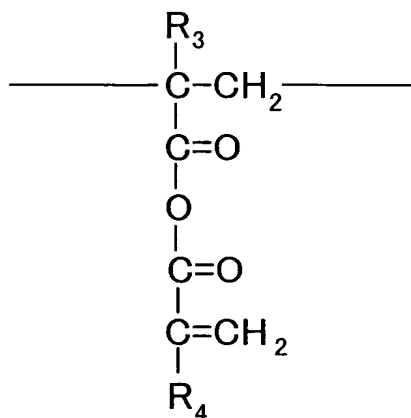
15

9. The method of claim 7, wherein the first positive photosensitive material has a structural unit represented by the following general formulas 1 and 2:

General formula 1



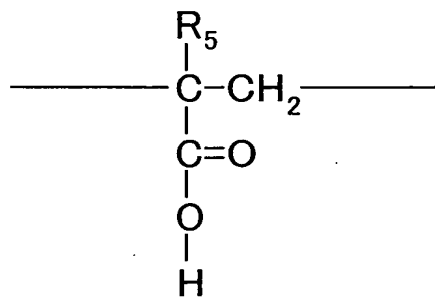
General formula 2



(wherein R₁ to R₄ denote a hydrogen atom or alkyl group having 1 to 3 carbon atoms and they may be the same or different from each other)

10. The method of claim 9, wherein the first positive photosensitive material has a structural unit represented by the following general formula 3:

General formula 3



(wherein R₅ denotes a hydrogen atom or alkyl group having 1 to 3 carbon atoms)

11. The method of claim 1, wherein the first wavelength band is shorter than the second wavelength band.

5 12. The method of claim 1, wherein the second positive photosensitive material is an ionizing radiation decomposable positive resist having polymethylisopropenyl ketone as a primary component.

10 13. A method of producing a liquid discharge head, which forms liquid flow path by forming a pattern of removable resin on a liquid flow path forming portion on a substrate having a liquid discharge energy generation element, applying and
15 hardening a resin coating layer on the substrate to coat the pattern and dissolving and removing the pattern, wherein the pattern is formed by the micro structure producing method of any one of claims 1 to
20 12.

14. The method of claim 13, wherein the developing solution of the first positive photosensitive material includes at least:

- 25 (1) glycol ether having 6 or more carbon atoms miscible with water at any certain ratio;
- (2) nitrogen-containing basic organic solvent;
- and

(3) a developing solution containing water.

15. The method of claim 14, wherein the glycol
ether comprises ethylenglycol monobutyl ether and/or
5 diethyleneglycol monobutyl ether.

16. The method of claim 14, wherein the
nitrogen-containing basic organic solvent comprises
preferably ethanolamine and/or morpholine.

10

17. A liquid discharge head produced by the
method of claim 13.

18. The liquid discharge head of claim 17,
15 wherein a column-shaped member for capturing dust is
formed on a liquid flow path as a material for
forming the liquid flow path and this member does not
reach to the substrate.

20 19. The liquid discharge head of claim 17,
wherein a liquid supply opening commonly connected to
each of the liquid flow paths is formed on the
substrate and the height of the liquid flow path on
the center portion of the liquid supply opening is
25 lower than that of the liquid flow path on an opening
circumferential portion of the liquid supply opening.

20. The liquid discharge head of claim 17,
wherein a bubble generating chamber has a convex
cross-sectional shape on the liquid discharge energy
generating element.

5

21. A method of producing a micro structure,
comprising the steps of:

forming on a substrate a first positive
photosensitive material layer for photosensitizing by
10 a light of a first wavelength band and forming a
thermally crosslinkable film by the first positive
photosensitive material layer by means of thermal
crosslinkable reaction;

forming on the first positive photosensitive
15 material layer a second positive photosensitive
material layer for photosensitizing by a light of a
second wavelength band different from the first
wavelength band;

reacting only a desired area of the second
20 photosensitive material layer by irradiating the
light of the second wavelength band through a mask to
the substrate surface formed with the first and
second positive photosensitive material layers,
forming a desired pattern by development then forming
25 a desired slope on a side wall of the pattern by
heating the substrate;

reacting a desired area of the first positive

photosensitive material layer by irradiating the light of the first wavelength band through a mask to the substrate surface formed with the first and second positive photosensitive material layers, and

5 which differentiates the upper and lower patterns with respect to the substrate using the process consisting of the above steps,

 wherein the first positive photosensitive material layer includes a ternary copolymer having
10 methyl methacrylate as a primary component, methacrylic acid as a thermally crosslinkable factor, and another factor for extending a sensitivity region relative to the ionizing radiation.

15 22. The method of claim 21, wherein the factor for extending the sensitivity region relative to the ionizing radiation is a methacrylate anhydride monomer unit.

20 23. The method of claim 21, wherein the thermal crosslinkable process of the first positive photosensitive material layer is carried out by dehydration and condensation reaction.

25 24. The method of claim 22, wherein the ternary copolymer contains methacrylate of 2 to 30% by weight relative to the copolymer and is prepared by cyclic

radical polymerization at a temperature of 100 to 120°C using an azo compound or peroxide as a polymerization initiator.

5 25. The method of claim 21, wherein the weight average molecular weight of the ternary copolymer is ranging of 5,000 to 50,000.

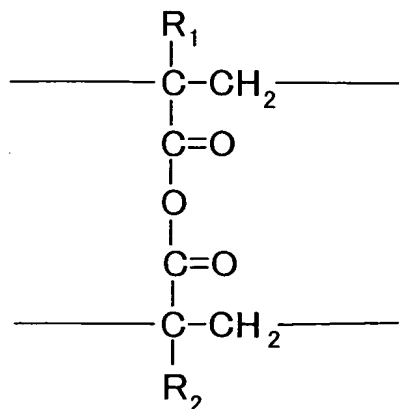
10 26. The method of claim 21, wherein the first positive photosensitive material contains at least a photo-degradable resin having a structure of carboxylate anhydride.

15 27. The method of claim 21, wherein the first positive photosensitive material is an acrylic resin that is intermolecular crosslinked through the structure of carboxylate anhydride.

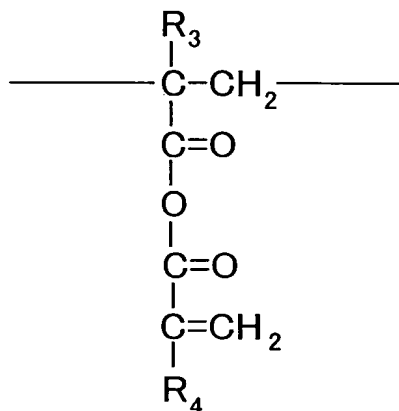
20 28. The method of claim 27, wherein the first positive photosensitive material is an acrylic resin having an unsaturated bond on a branched chain.

25 29. The method of claim 27, wherein the first positive photosensitive material has a structural unit represented by the following general formulas 1 and 2:

General formula 1



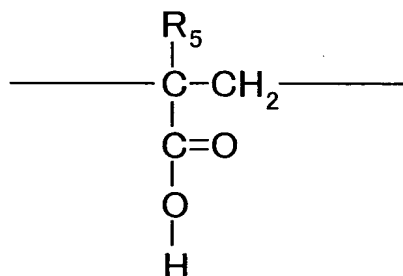
General formula 2



(wherein R_1 to R_4 denote a hydrogen atom or alkyl group having 1 to 3 carbon atoms and they may be the same or different from each other)

30. The method of claim 29, wherein the first positive photosensitive material has a structural unit represented by the following general formula 3:

General formula 3



(wherein R₅ denotes a hydrogen atom group or alkyl group having 1 to 3 carbon atoms)

31. The method of claim 21, wherein the first wavelength band is shorter than the second wavelength band.

32. The method of claim 21, wherein the second positive photosensitive material is an ionizing radiation decomposable positive resist having polymethylisopropenyl ketone as a primary component.

33. A method of producing a liquid discharge head, which forms liquid flow path by forming a pattern of removable resin on a liquid flow path forming portion on a substrate having a liquid discharge energy generation element, applying and hardening a resin coating layer on the substrate to coat the pattern and dissolving and removing the pattern, wherein the pattern is formed by the micro

structure producing method of any one of claims 21 to 32.

34. The method of claim 33, wherein the
5 developing solution of the first positive
photosensitive material includes at least:

(1) glycol ether having 6 or more carbon atoms
miscible with water at any certain ratio;

(2) nitrogen-containing basic organic solvent;
10 and

(3) a developing solution containing water.

35. The method of claim 34, wherein the glycol
ether comprises ethylenglycol monobutyl ether and/or
15 diethyleneglycol monobutyl ether.

36. The method of claim 34, wherein the
nitrogen-containing basic organic solvent comprises
preferably ethanolamine and/or morpholine.
20

37. A liquid discharge head produced by the
method of claim 33.

38. The liquid discharge head of claim 37,
25 wherein a column-shaped member for capturing dust is
formed on a liquid flow path as a material for
forming the liquid flow path and this member does not

reach to the substrate.

39. The liquid discharge head of claim 37,
wherein a liquid supply opening commonly connected to
5 each of the liquid flow paths is formed on the
substrate and the height of the liquid flow path on
the center portion of the liquid supply opening is
lower than that of the liquid flow path on an opening
circumferential portion of the liquid supply opening.

10

40. The liquid discharge head of claim 33,
wherein a bubble generating chamber has a convex
cross-sectional shape on the liquid discharge energy
generating element.